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APRIL 1973, No. 4

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SERVICE

OUTHWEST
FISHERIES
CENTER
LA JOLLA,
CALIFORNIA

U.S. DEPARTMENT OF COMMERCE
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NATIONAL MARINE FISHERIES SERVICE
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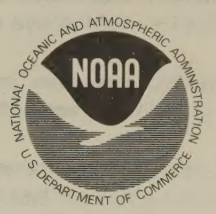
APRIL 1973, No. 4



Editor – R. M. Laurs

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F. Hester, Director, Honolulu Laboratory

PREFACE

This publication, Fishing Information, appears monthly and contains 1) fishery advisory information, 2) a narrative description of pertinent surface temperature conditions, 3) a narrative description of subsurface temperature structure for parts of the North Pacific, 4) charts of winds and pressures for the eastern North Pacific, 5) charts of sea surface temperature for the North Pacific and eastern tropical Pacific, and 6) charts of subsurface temperature structure in the eastern North Pacific.

A supplement to Fishing Information appears at 15-day intervals throughout the year. This is a chart of sea surface temperature (contoured at 2°F (1°C) intervals) from Baja California to Vancouver Island out to about 135°W. Special bulletins are published in conjunction with the 15-day sea surface temperature charts which include short-term projections of albacore distribution and locations of productive fishing areas, information on oceanographic and atmospheric conditions, and other information as is appropriate during the albacore fishing season.

R. Michael Laurs, Leader
Fishery-Oceanography Investigations
La Jolla, California

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CONTENTS

PAGE

Acknowledgements iv

Sea Surface Temperature and Environmental Conditions - April 1973. L. Eber and F. Miller 1

Subsurface Temperature Structure in the Northeast Pacific Ocean. J. F. T. Saur 2

Airborne Infrared Sea Surface Temperature Survey off San Diego. R. M. Laurs and J. Squire. 2

ENVIRONMENTAL CHARTS, PACIFIC OCEAN - APRIL 1973

Figure 1. Thirteen-year mean (1961-73) observed sea level values of barometric pressure (millibars), resultant wind direction (degrees true), resultant wind speed (knots) and average wind speed (knots) regardless of direction. 4

Figure 2. Observed sea level values of barometric pressure (millibars), resultant wind direction (degrees true), resultant wind speed (knots) and average wind speed (knots) regardless of direction 5

Figure 3. Mean sea surface temperature, eastern North Pacific Ocean. Squares show temperatures at weathership stations. Numerals on shore are temperatures at coastal and lightship stations 6

Figure 4. Mean sea surface temperature chart, western North Pacific Ocean. 7

Figure 5. Deviation of sea surface temperatures, eastern North Pacific Ocean from long-term charts of H. O. 225. Harched areas are colder in 1973 8

Figure 6. Deviation of sea surface temperatures, eastern North Pacific Ocean from those of April 1972. Hatched areas are colder in 1973 9

Figure 7. Mean sea surface temperature, eastern tropical Pacific Ocean. Numerals on shore are temperatures at coastal stations 10

Figure 8. Deviation of sea surface temperatures, eastern tropical Pacific Ocean from long-term charts of H. O. 225 and NAVOCEANO sp-123. Shaded areas are colder in 1973. Contours are dashed in sparse data areas 11

Figure 9. Deviation of sea surface temperatures, eastern tropical Pacific Ocean from those of April 1972. Shaded areas are colder in 1973. Contours are dashed in sparse data areas. 12

Figure 10. Surface temperature and salinity and subsurface temperature structure from expendable bathythermograph observations between San Francisco and Honolulu: April 17-22, 1973. 13

Figure 11. Airborne Infrared Sea Surface Temperature Survey off San Diego on April 2, 11, 16 and 23. 14

ENVIRONMENTAL CHARTS ANALYZED BY:

L. Eber (Figure 4), F. Miller (Figures 7, 8, and 9)
J. Renner (Figures 1, 2, 3, 5, and 6), J. F. T. Saur (Figure 10)
J. Squire (Figure 11)

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K. Raymond

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Expendable bathythermograph observations are made by the Mates of the S. S. Chevron Mississippi of Chevron Shipping Co., and processed with assistance from the NMFS Environmental Group, Monterey: Project partially supported by National Science Foundation Grant AG-256.

Sea Surface Temperature and Environmental Conditions

L. EBER AND F. MILLER

Eastern North Pacific

Seasonal warming was evident over much of the eastern north Pacific in April 1973 as sea surface temperatures rose above mean values for March everywhere except in coastal waters south of latitude 40° N, and in some areas centered along latitude 45° N, west of 140° W. The temperature changes from March to April were generally less than 2° F (1.1° C) in magnitude and, except in the areas of cooling, were not very different from normal. Consequently the pattern of sea temperature deviations (Fig. 5) remained weak, although slightly altered from conditions a month earlier.

The cooler coastal waters south of 40° N resulted in an expanded region of negative deviations from approximately 140° W to the coasts of California and Baja California. Negative deviations also spread in the neighborhood of 45° N, 150° W and along 40° N, west of 160° W, where temperatures in April were below those in March. On the other hand, temperatures west of 145° W and south of 30° N increased faster than normal and positive deviations have spread throughout most of this region.

Atmospheric conditions in April 1973 were characterized by anticyclonic flow around high barometric pressure centered near 35° N, 140° W. Southwest flow prevailed between the high center and low pressure south of the Aleutians (Fig. 2). The pressures in the latter region were about 6 millibars below normal, reflecting unusually strong cyclonic activity during the month. Resultant winds west of 160° W, between 45° N and 50° N were more northerly than normal, which contributed to the observed reversal of spring warming through transport of cold water southward. Heat loss by evaporation and conduction was also greater than normal under this circulation regime.

Similar processes were at work in the coastal zone out to 130° W, where strong north winds prevailed over the areas in which spring warming was retarded or reversed.

The cooling in offshore waters around 45° N, 150° W is not so readily explained by simple indices of north-south wind stress components. In fact, this area was subjected to southerly winds on about 20 days in April, implying relatively warmer surface temperatures, and the computed net heat flux downward across the ocean surface was in excess of normal. It is conceivable that surface temperatures observed in March, which were a little above normal, represented a transient, relatively shallow warm layer and the steady April winds, which averaged 20 knots during the month, reduced surface temperatures by mixing this layer with cooler water below.

Eastern Tropical Pacific

The expected cooling trend has continued along the coast of South America and near the equator, particularly east of 110° W. The usual seasonal cooling in the Peru Current from March to April is 2°-3° F (1.1°-1.7° C) and about 1° F in the equatorial upwelling area around the Galapagos Islands. In April sea surface temperatures to the north and east of the Galapagos (Fig. 7) cooled very rapidly in April with negative anomalies of 4°-6° F (2.2°-3.3° C) appearing for the first time in over a year. Although few in number, all ships crossing the equator near the Galapagos encountered the colder surface water. The rapid cooling of sea surface temperatures in the Peru Current and its equatorial extension was associated with significant increases in surface pressure gradients, wind speeds and cloud cover off the coast of South America and along the equator out to 110° W.

The eastern tropical Pacific between 5° N and 15° N experienced near-normal conditions with seasonal warming of about 2° F (1.1° C) taking place from Central America to 100° W along 10° N. Some cooling occurred off Mexico between 15° N and 20° N as cloud cover limited solar heating and persistent northerly winds of 12-15 knots prevailed throughout the month. Near 10° N, between 125° W and 140° W the northeast trades blew consistently at 15-20 knots and caused considerable surface mixing and a deep mixed layer.

Subsurface Temperature Structure in the Northeast Pacific Ocean

J. F. T. SAUR

The subsurface temperature structure between San Francisco and Honolulu for April 17-22, 1973 is shown in Figure 10, prepared from expendable bathythermograph observations taken from the tanker, Chevron Mississippi.

From March to April the net transfer of heat from the atmosphere to the ocean is increasing. One effect of this is to create the small transient thermoclines or multiple thermoclines shown in the selected individual profiles. The "mixed" layer depths decrease and become more variable from station to station. The warming in the surface layers since the last section of March 20-25, 1973, has been about 1.0° F (0.5° C) which is about typical, except within a few hundred miles of the central California coast where the advective effect of the California Current and some upwelling extract heat from the region and have held the temperatures about the same.

The transition region, which lies between the outer boundary of the California Current and the North Pacific Central water, is of interest because of its possible effect on albacore migrations. Along the San Francisco-Honolulu route there is a noticeable difference in the oceanic conditions this year as compared with 1972 in this complex region between 132° and 142° W longitude, that is, between 500 and 1000 nautical miles from the California coast. This year the surface salinity remains below 33.6‰, which is characteristic of the California Current, from the coast westward for about 550 miles or 133° W. It rises to and remains at an intermediate level of 34‰ for about 400 miles. It then increases to values higher than 34.6‰, characteristic of North Pacific Central water, beyond 141° W or about 950 miles out. Surface salinities thus indicate that the transition region is spread out over a distance of at least 400 miles. In April 1972 this change in surface salinity occurred within a distance of only about 150 miles between longitudes 137° and 140° W, that is, in the region between 750 and 900 miles from the coast.

In both years at depths of 200-500 meters there is one narrow band where the subsurface isotherms (7°-13° C) slope sharply downward to the west. This year it is located between stations 9 and 10 near 140° W (900 miles) and is associated with the western edge of the transition in surface salinity. In 1972, however, the band of rapid change in subsurface temperature occurred farther east near 137° W (750 miles) and was associated with the eastern edge of the transition region at the surface, that is, the western boundary of California Current water at the surface.

The reservoir of heat in the surface layer is also greater than in 1972 in the region between 500 and 900 miles from the coast. Although the surface temperature is slightly lower than in 1972, the average temperature of the 0-100 meter layer is 1.0°-1.8° F (0.5°-1.0° C) warmer than last year.

The above conditions indicate that the transition zone between the North Pacific Central water and the waters of the California Current continues to be more diffuse and broader this year than last, its eastern edge is closer to the coast, and the flow of the California Current appears somewhat weaker.

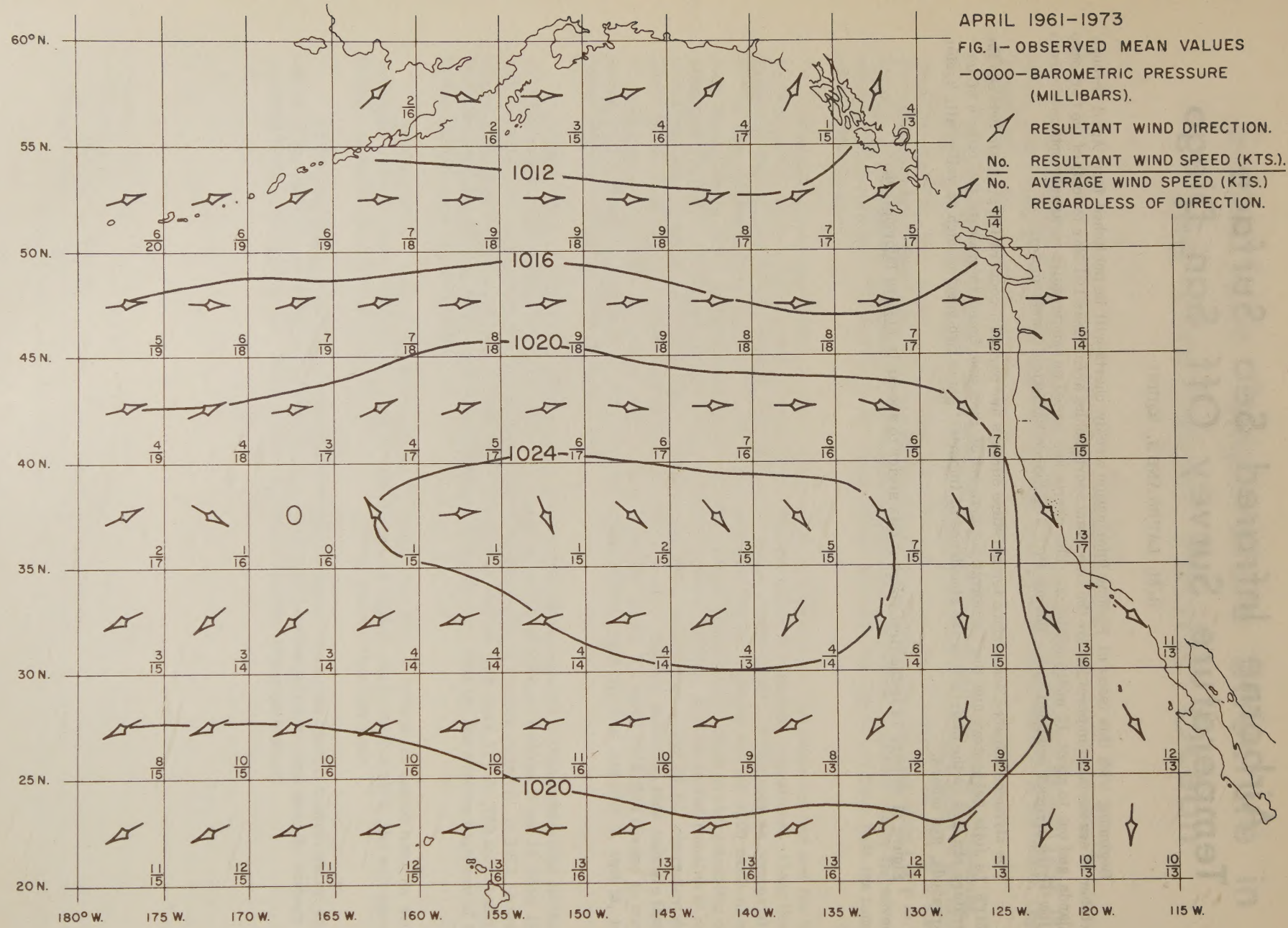
Airborne Infrared Sea Surface Temperature Survey Off San Diego

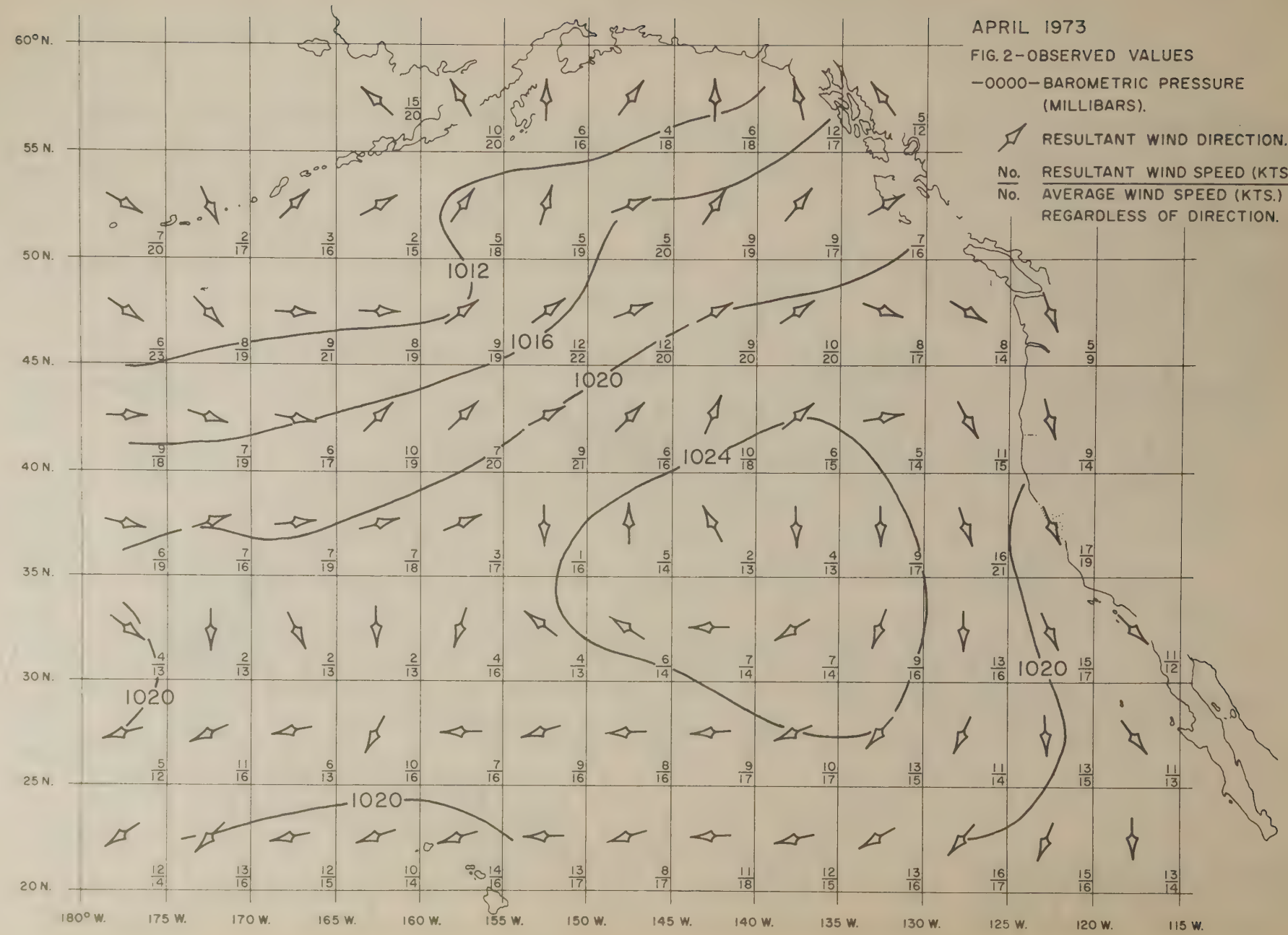
R. M. LAURS AND J. SQUIRE

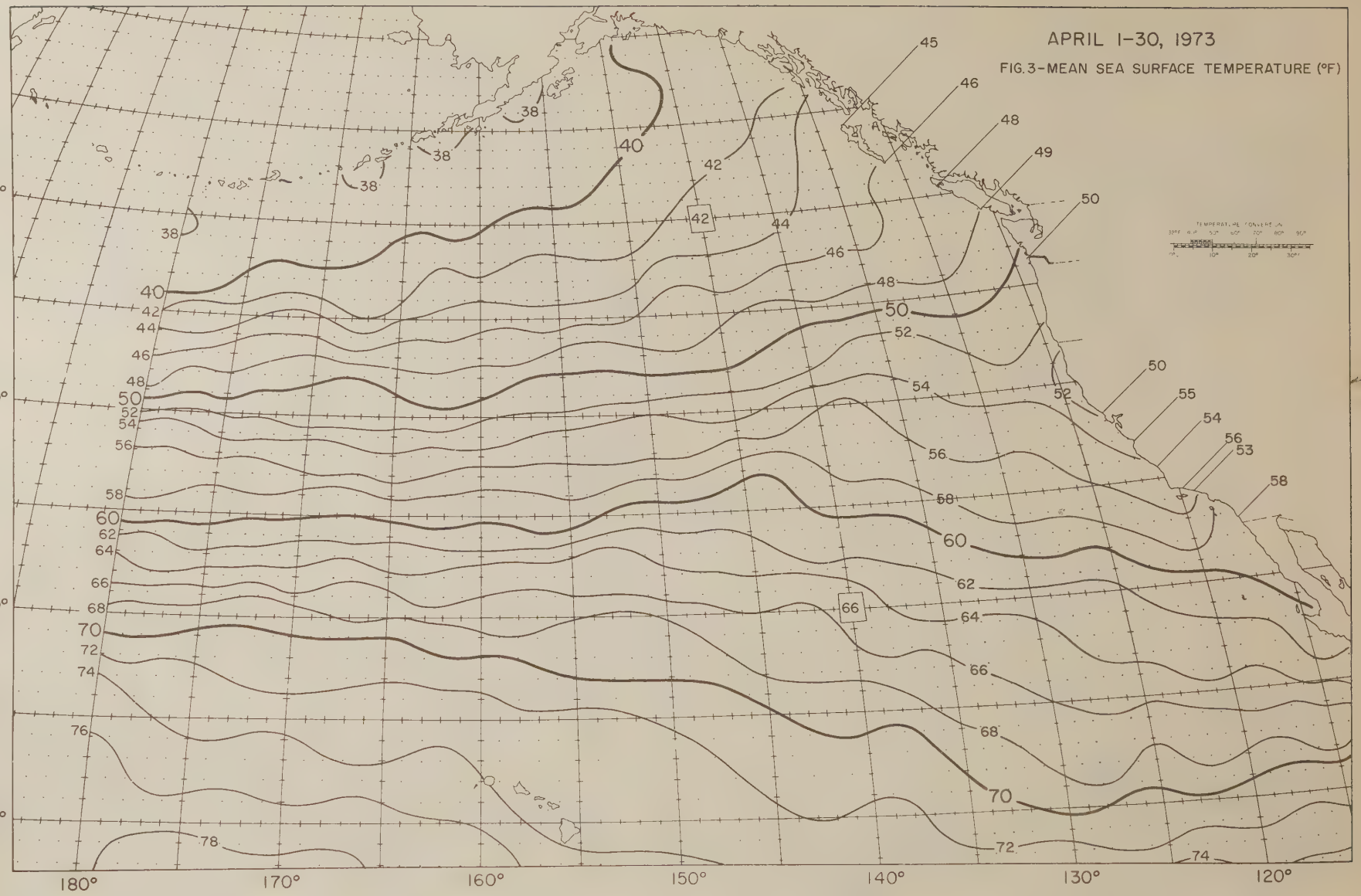
Beginning with this issue of Fishing Information weekly charts will be published from April through October of sea surface temperature for the important sportsfishing areas near Del Mar to south of the Coronado Islands and out to about 15 miles offshore. The charts are based on temperature measurements made from a low-flying aircraft equipped with a Barnes PRT 5 Airborne Radiation Thermometer.

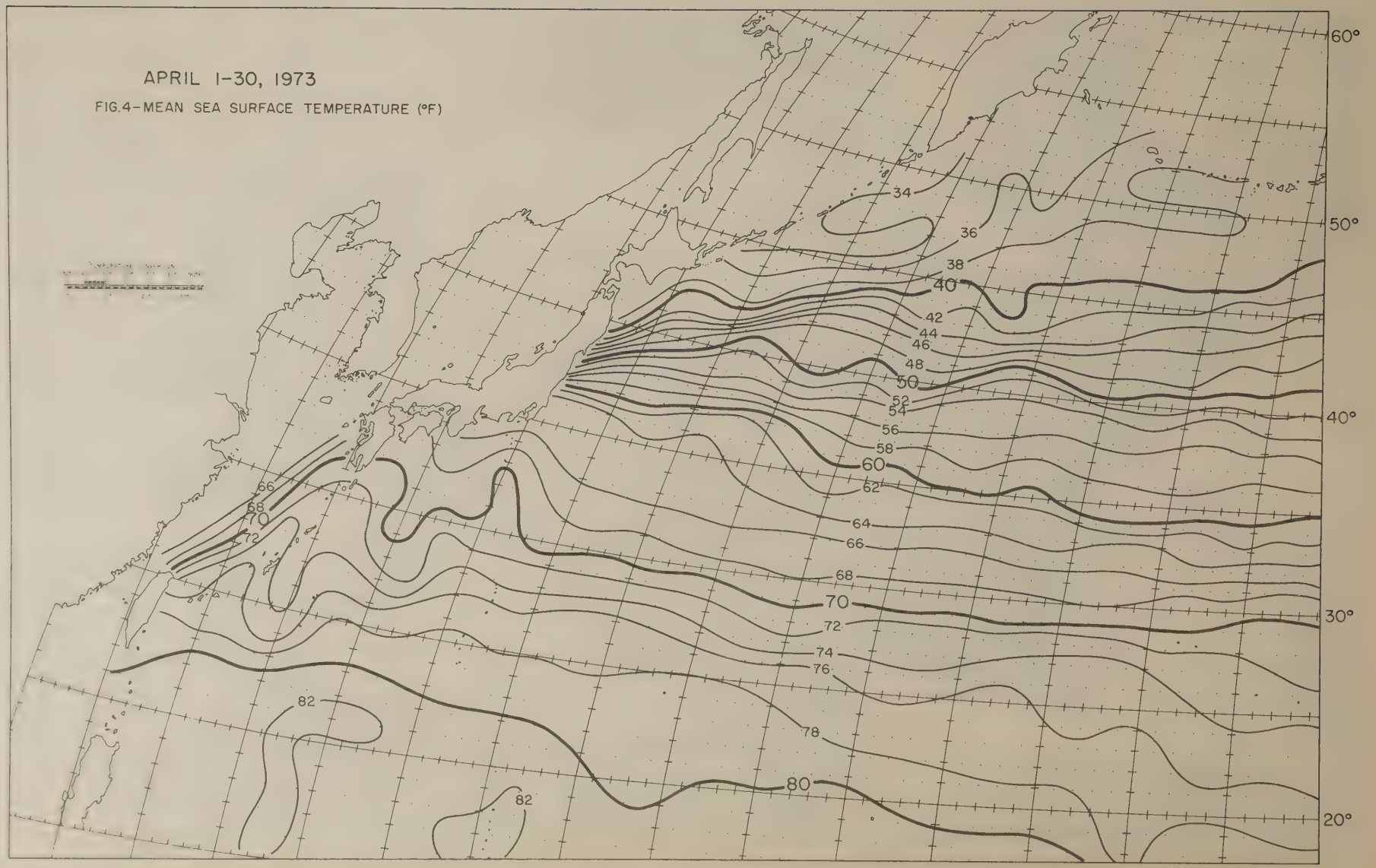
The airborne infrared sea surface temperature surveys are part of a cooperative program between the NMFS La Jolla Laboratory and the California Department of Fish and Game to evaluate the effects of temperature changes on the distribution and abundance of important game fish species such as yellowtail, bonito, barracuda, and others.

Figure 11 on page 14 is the first chart of this series to appear in Fishing Information.


APRIL 1961–1973
FIG. 1– OBSERVED MEAN VALUES
–0000– BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. RESULTANT WIND SPEED (KTS.).
No. AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
1012
1016
1020
1024
1020
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.


APRIL 1973
FIG. 2 - OBSERVED VALUES
—0000— BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. / No. RESULTANT WIND SPEED (KTS.) / AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
1012
1016
1020
1024
1020
1020
1020
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.


APRIL 1-30, 1973
FIG.3-MEAN SEA SURFACE TEMPERATURE (°F)
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°


APRIL 1-30, 1973
FIG.4-MEAN SEA SURFACE TEMPERATURE (°F)
60°
50°
40°
30°
20°
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
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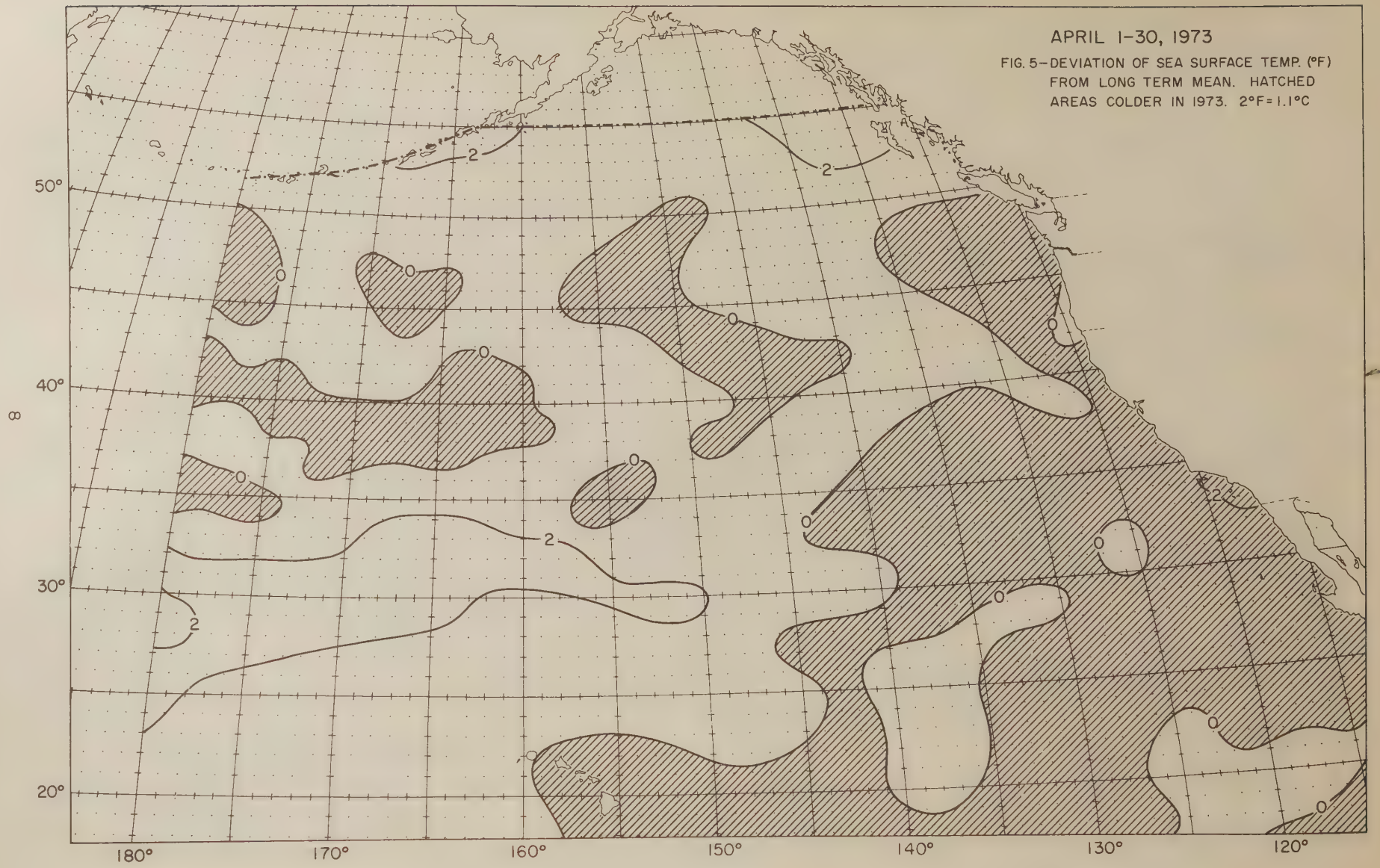
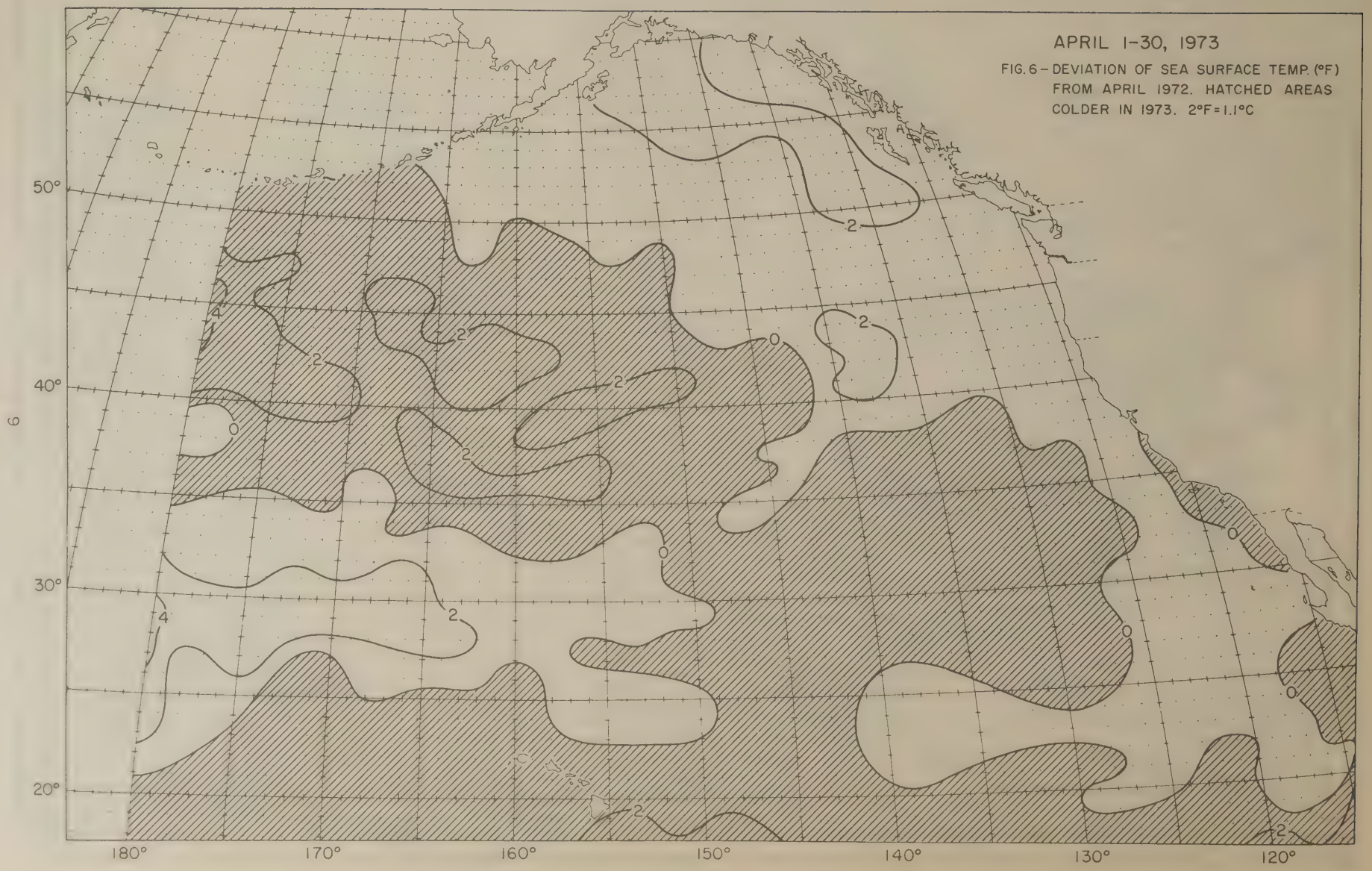
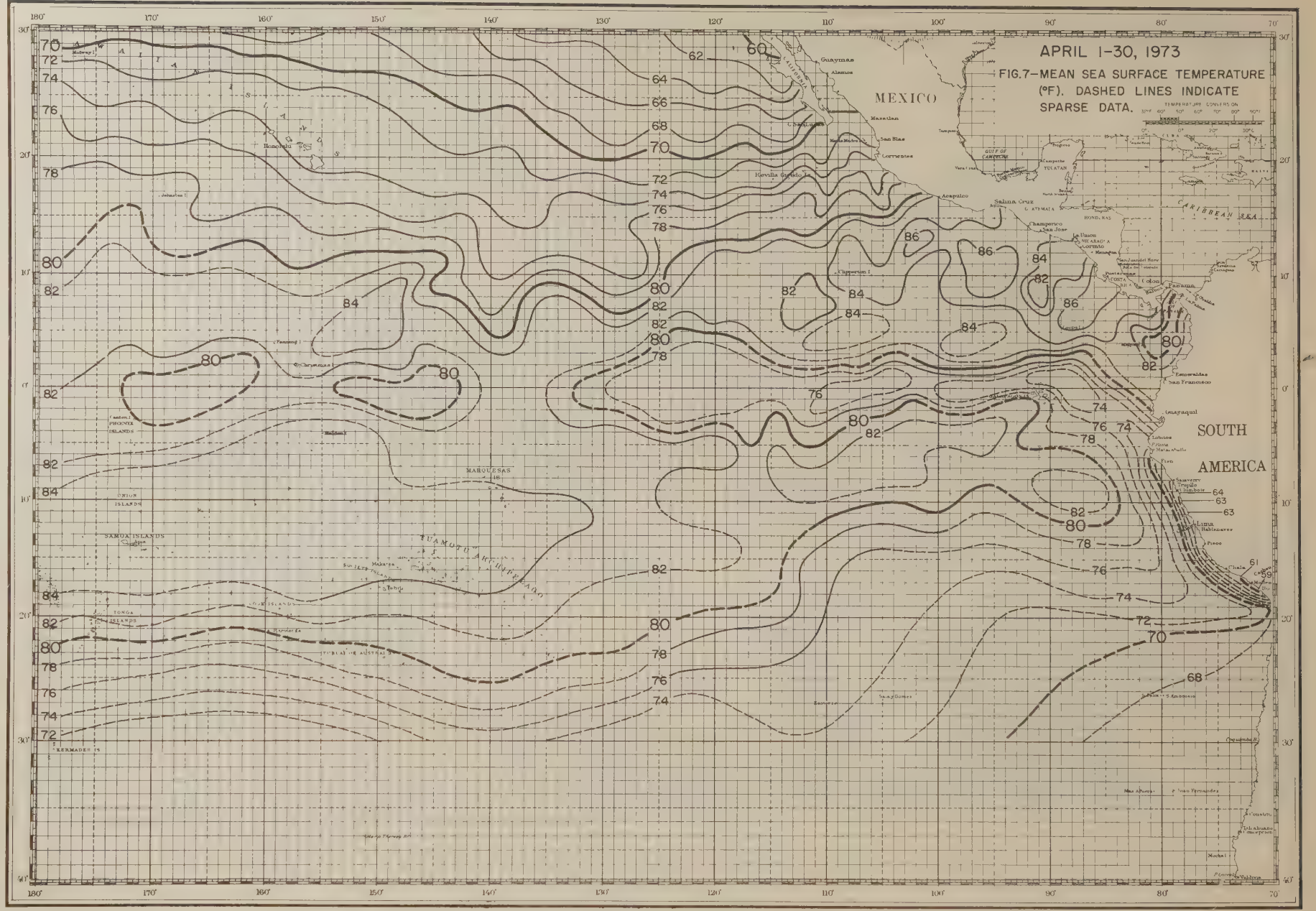
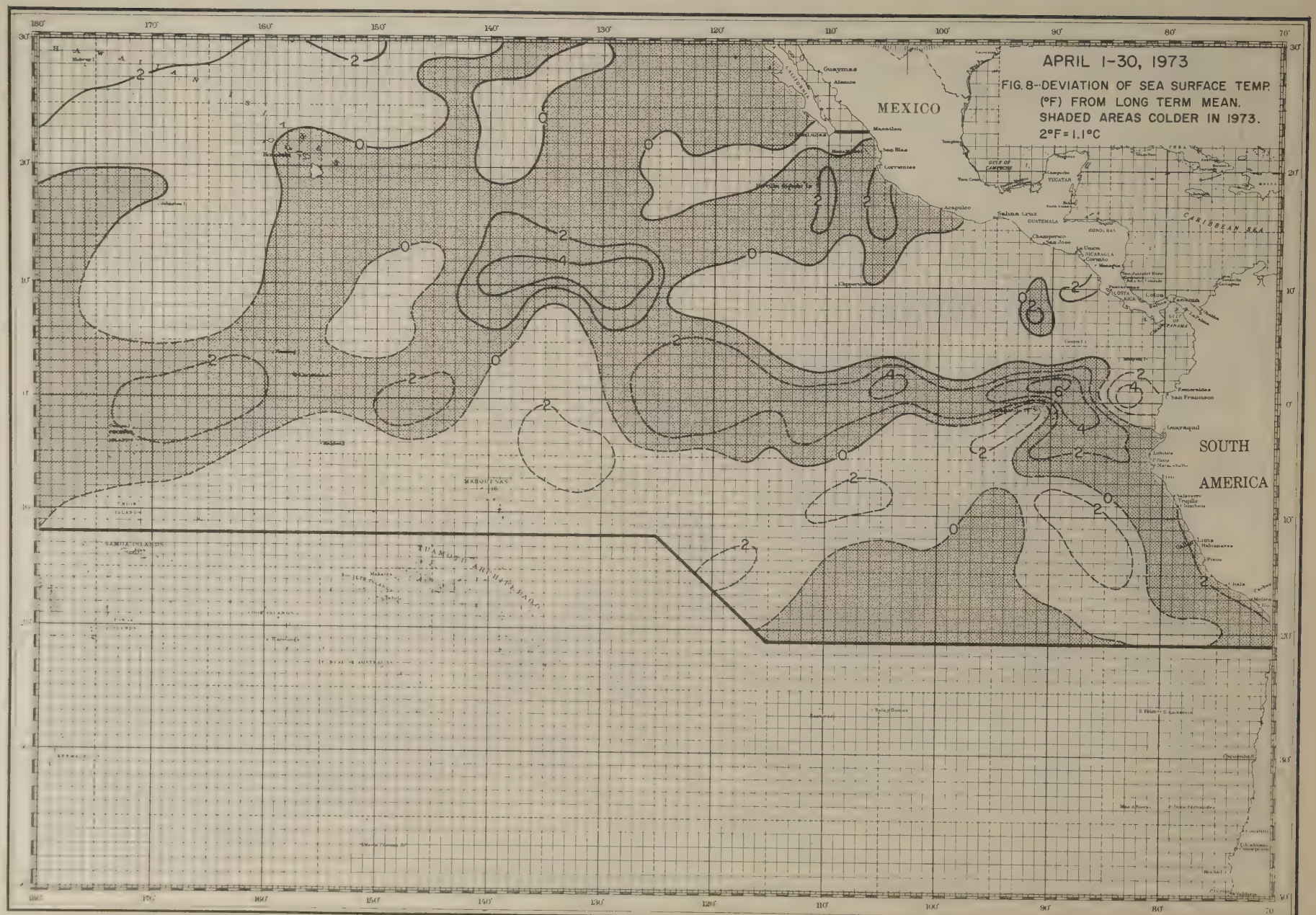
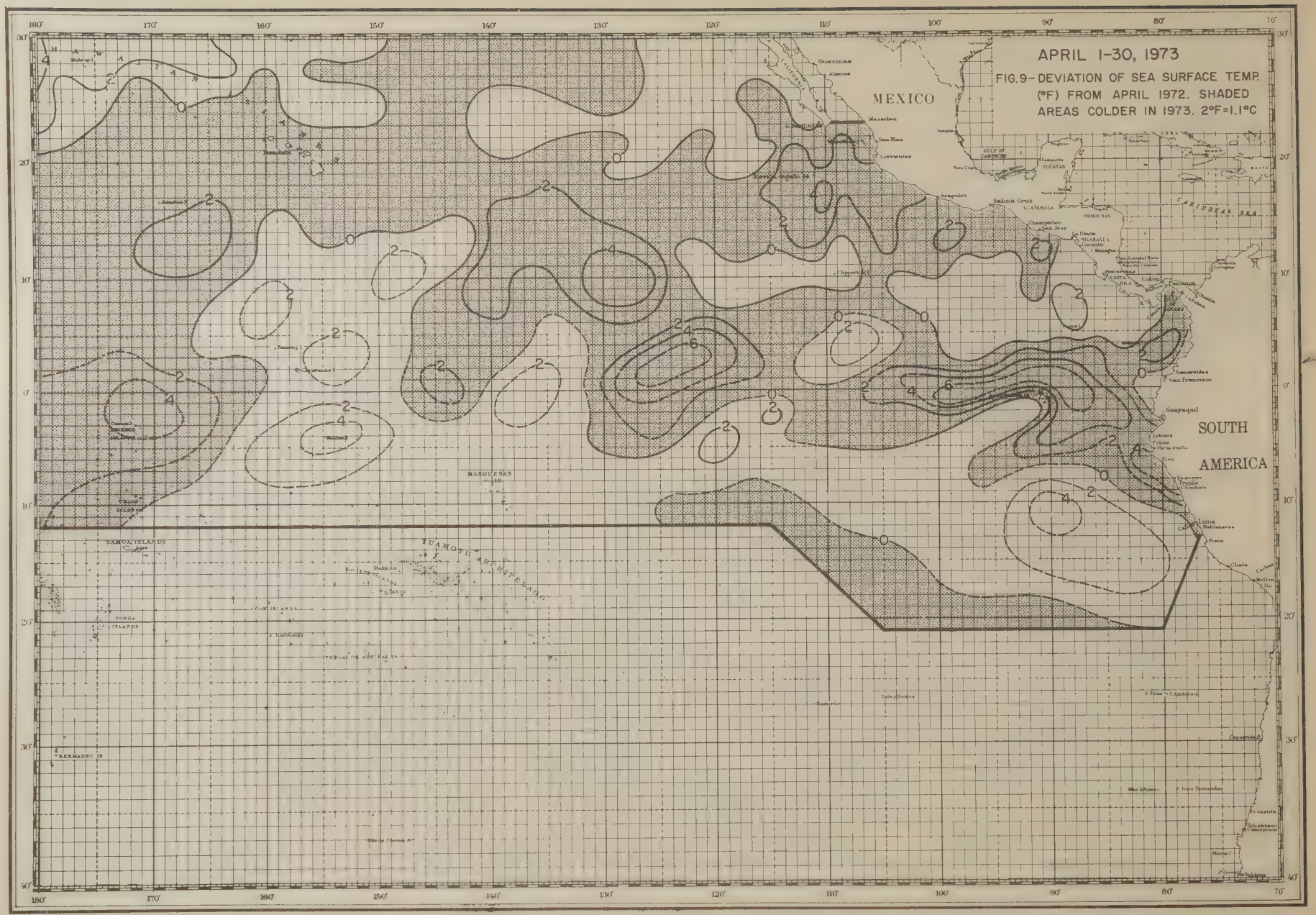
68
70
72
74
76
78
80
82
66
68
70
72
82


APRIL 1-30, 1973
FIG. 5-DEVIATION OF SEA SURFACE TEMP. (°F) FROM LONG TERM MEAN. HATCHED AREAS COLDER IN 1973. 2°F = 1.1°C
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
0
2


APRIL 1-30, 1973
FIG. 6 – DEVIATION OF SEA SURFACE TEMP. (°F) FROM APRIL 1972. HATCHED AREAS COLDER IN 1973. 2°F = 1.1°C
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
4
2
0
2
2
2
2
0
2
0
4
2
0
0
2
2

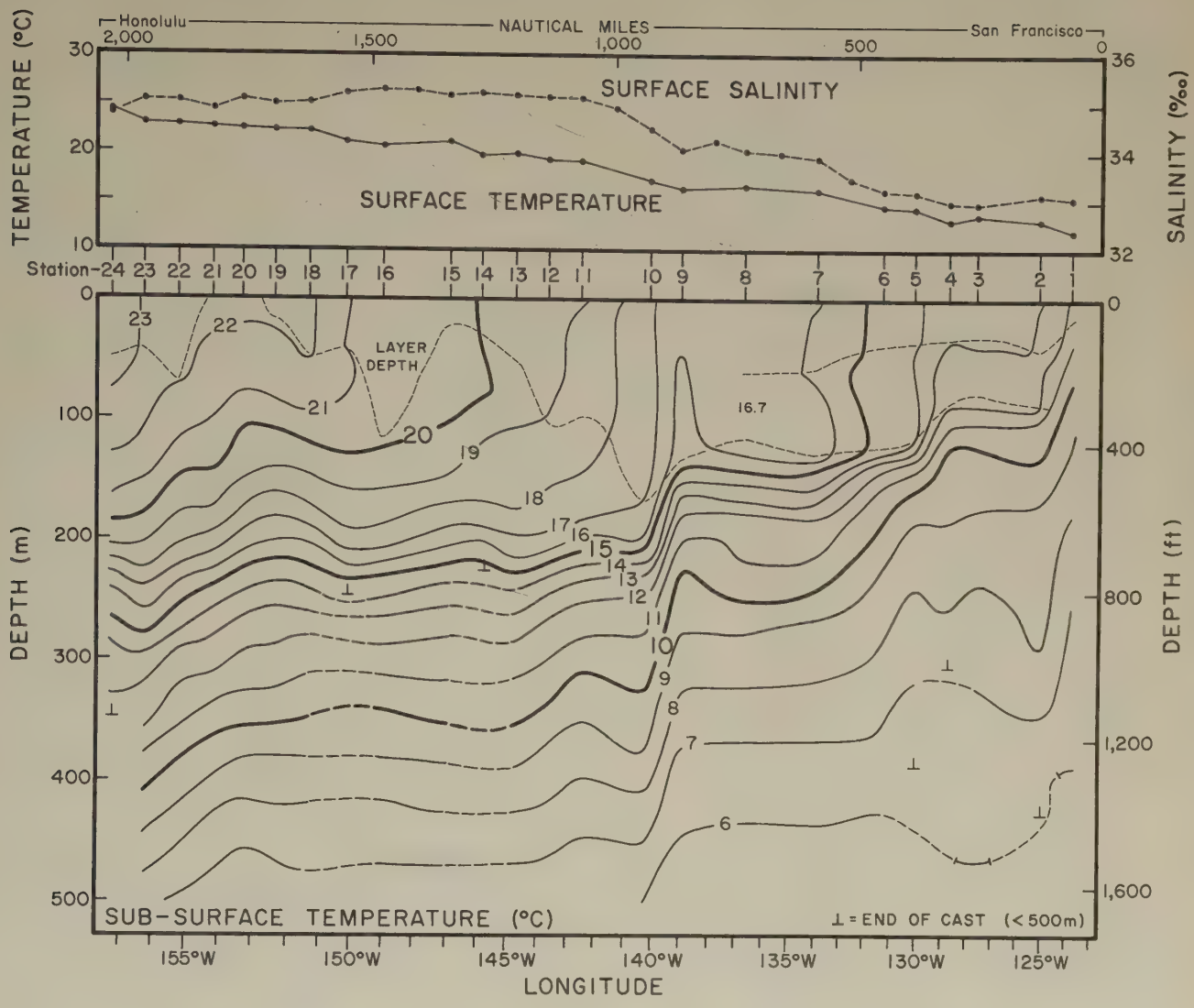

APRIL 1-30, 1973
FIG.7—MEAN SEA SURFACE TEMPERATURE (°F). DASHED LINES INDICATE SPARSE DATA.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GULF OF CALIFORNIA
GULF OF PANAMA
Guaymas
Alamos
Mazatlan
San Blas
Corrientes
Acapulco
Salina Cruz
Champerico
Union
Colon
Panama
Esmeraldas
San Francisco
Guayaquil
Lobitos
Talara
Paita
Callao
Lima
Pisco
Chile
Honolulu
HAWAIIAN ISLANDS
MARQUESAS
SAMOA ISLANDS
TONGA ISLANDS
TUAMOTU ARCHIPELAGO
SOCIETY ISLANDS
Tahiti
Makatea
Rapid Eye
KERMADEC IS
Eastern PHOENIX ISLANDS
UNION ISLANDS
Juan Fernandez
Mas Afuera
Mocha I
Isla de S Ambrosio
Isla de Pascua
Pitcairn I
Oeno I
Henderson I
Ducie I
Easter I
Caroline I
Flint I
Vostok I
Malden I
Fanning I
Christmas I
Jarvis I
Johnston I
Palmyra I
Kingman Reef
Howland I
Baker I
Enderbury I
Canton I
Hull I
Orona I
Nikumaroro I
Sydney I
Nukumanu Is
Ontong Java Is
Nuguria Is
Tasman Is
Rennell I
Bellona I
Santa Cruz Is
Reef Is
Duff Is
Vanikoro Is
Banks Is
Torres Is
Espiritu Santo I
Malekula I
Efate I
Erromango I
Tanna I
Aneityum I
Futuna I
Aniwa I
Matthew I
Hunter I
Norfolk I
Lord Howe I
Kermadec Is
Raoul I
Macauley I
Curtis I
Sunday I
Macquarie I
Auckland Is
Campbell I
Antipodes Is
Bounty Is
Chatham Is
Solander I
Stewart I
Snares Is
Auckland I

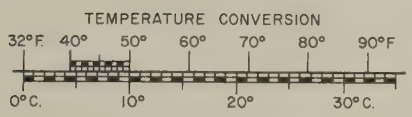

APRIL 1-30, 1973
FIG. 8--DEVIATION OF SEA SURFACE TEMP. (°F) FROM LONG TERM MEAN. SHADED AREAS COLDER IN 1973.
2°F = 1.1°C
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GUATEMALA
HONDURAS
NICARAGUA
COSTA RICA
PANAMA
GULF OF CALIFORNIA
GULF OF PANAMA
YUCATAN
Guaymas
Mazatlan
San Blas
Acapulco
Salina Cruz
Champerico
Corinto
Panama
Guayaquil
Tumbes
Talara
Paita
Pisco
Lima
Callao
Arica
Iquique
Antofagasta
Valparaiso
MARQUESAS
EASTER ISLAND
SAMOA ISLANDS
TUAMOTU ARCHIPELAGO
GALAPAGOS

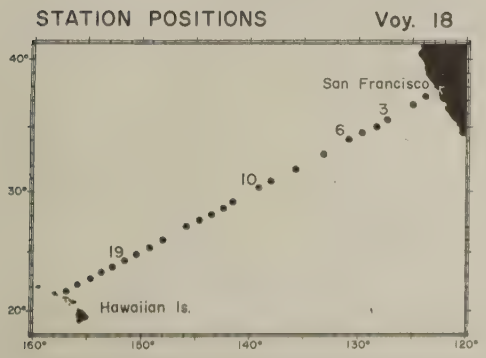

APRIL 1-30, 1973
FIG.9- DEVIATION OF SEA SURFACE TEMP. (°F) FROM APRIL 1972. SHADED AREAS COLDER IN 1973. 2°F=1.1°C
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
MARQUESAS
TUAMOTU ARCHIPELAGO
SAMOA ISLANDS
TONGA ISLANDS
Guayaquil
Lima

APRIL 17–22, 1973
SS CHEVRON MISSISSIPPI, Voyage 18

FIGURE 10.







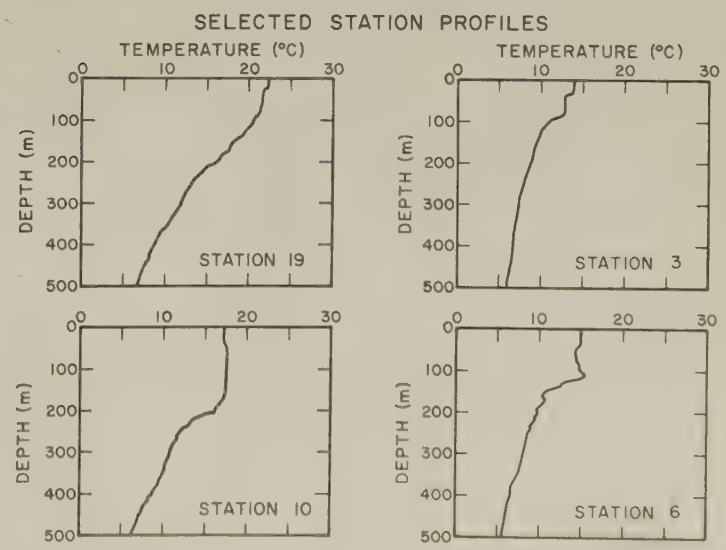
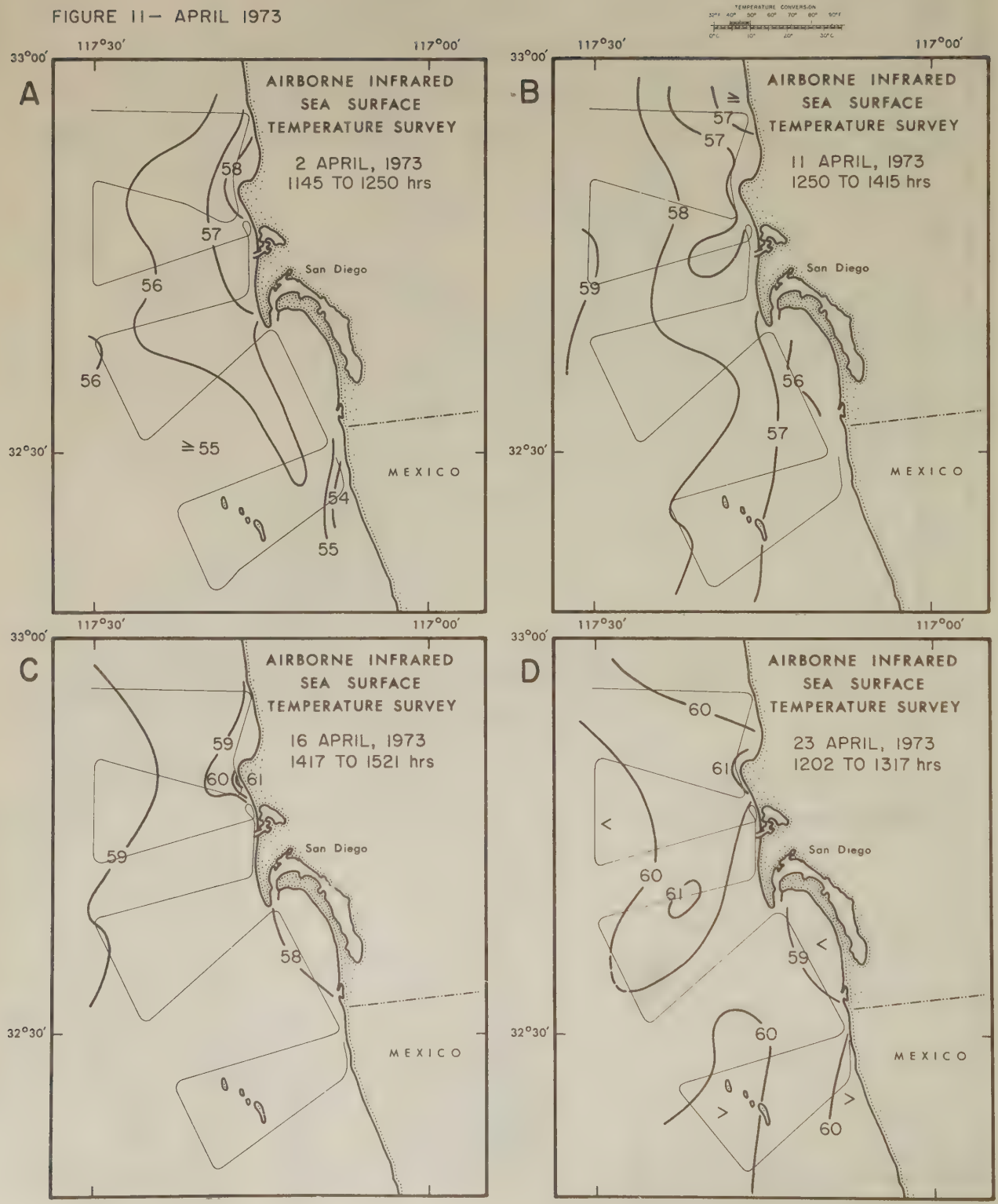


FIGURE 11– APRIL 1973



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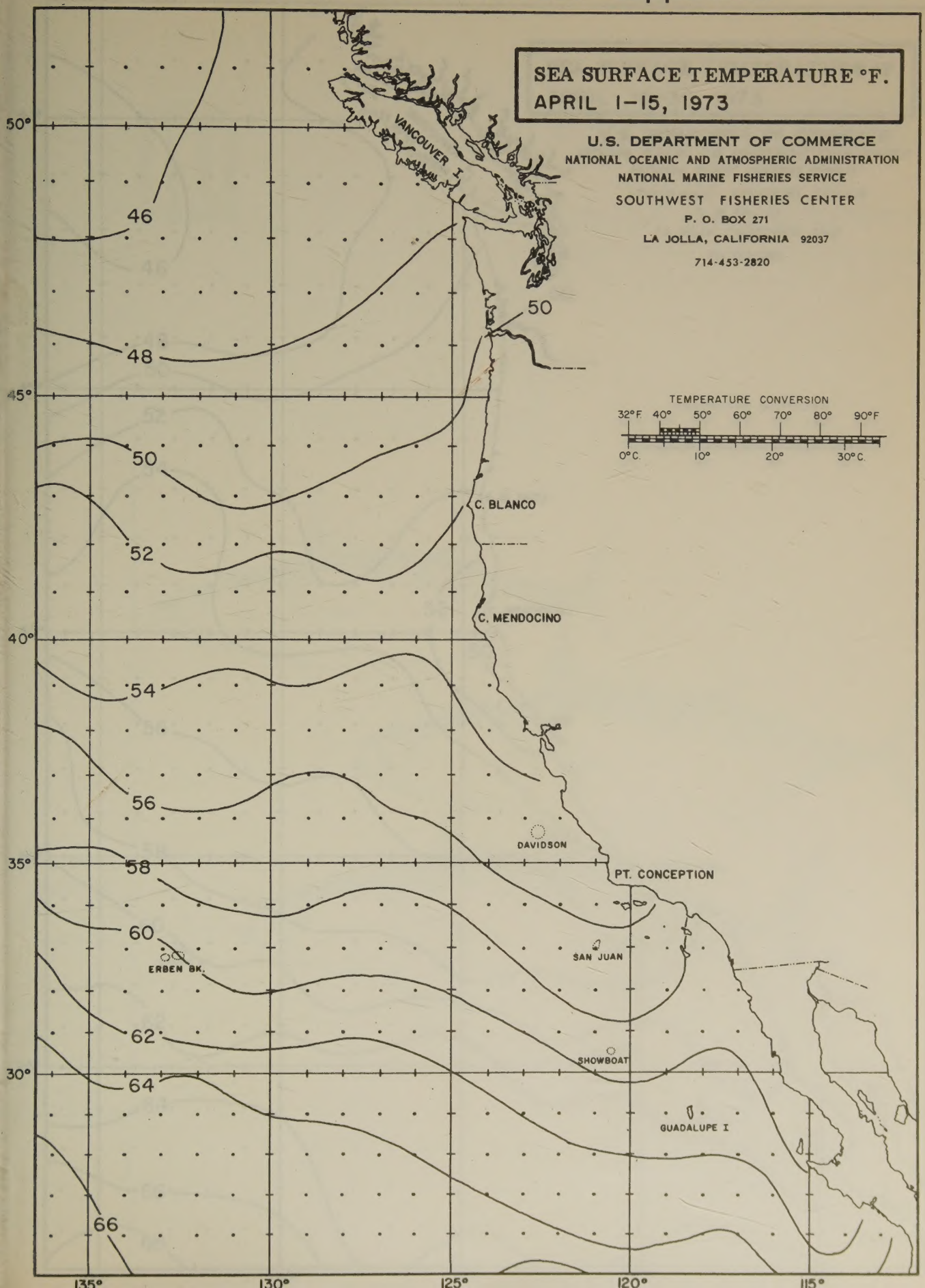

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